National Renewable Energy Laboratory - China Activities

Debra Lew

National Renewable Energy Laboratory

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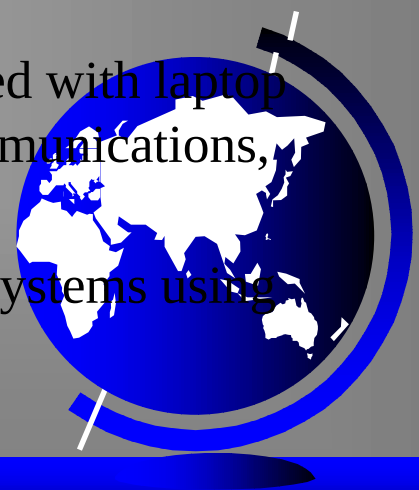
NREL's China Renewable Energy Activities

- US/China Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy (Protocol), led by US DOE/MOST, started in 1995
  - Annex 1 Rural Energy Development
  - Annex 2 Wind Development
  - Annex 4 Business Development
- Technology Cooperation Agreement Pilot Project/Clean Air and Clean Energy Technology Cooperation (CACETC), led by US EPA/SDPC, started 1998
  - Grid-connected Wind Power
  - Energy efficient motors

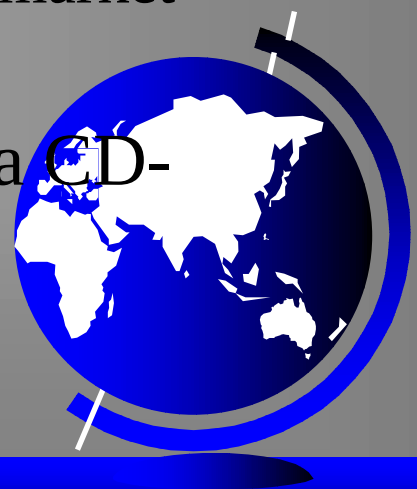
Gansu Solar Home System Project

- DOE/NREL, Ministry of Agriculture, Solar Electric Light Fund, Gansu Solar Electric Light Fund
- Phase 1: 320 solar home systems and 10 PV schools
- Experiments with financing and subsidies; revolving credit fund established
- As a result of this project:
  - Additional 275 PV systems were installed by the provincial government
  - Ministry of Agriculture expanded its solar home system project to 10,000 households in 6 provinces.
- Next steps:
  - Solar Electric Light Fund - two PV school systems equipped with laptop computers for education; future plans may include telecommunications, internet, tele-medicine, tele-education, e-commerce
  - Gansu Solar Electric Light Fund - completing solar home systems using revolving credit fund



Rural Biomass Collaboration

- DOE/NREL, MOA, Center for Renewable Energy Development
- Three joint assessments
  - Biomass resource assessment
  - Biomass conversion technologies
  - Technical and economic assessment including market-based strategies and policies for dissemination
- Published as a bilingual set of three books a CD-ROM. Also at www.nrel.gov/china



Inner Mongolia Hybrid Household Project

- DOE/NREL, Inner Mongolia New Energy Office, University of Delaware, Chinese Academy of Sciences
- Case studies on household and village power systems, including technical performance and economic analyses of 41 households and three villages.
- Pilot project - 341 household PV/wind systems will be installed by end of 2000.
- As a result of this activity, local officials in Dongwu County have completed a feasibility study and plan for 4,000 hybrid systems to be installed over the next 5 years.

Rural Energy Survey and Analysis

- MOA, University of Delaware, Chinese Academy of Sciences and DOE/NREL
- Surveyed rural counties in Xinjiang, Qinghai and Inner Mongolia - collected data on willingness-to-pay, current energy usage, and energy demand.
- MOA staff completed a survey and analysis training at U. of Delaware
- Using energy demand and local income data, MOA and U. of Delaware analyzed least-cost renewable energy systems options for each region.
- A report is currently being finalized.

Asia Pacific Economic Cooperation (APEC) Tibet Solar Electrification Project

- APEC/DOE/NREL, Lhasa government, Lotus Energy, Wisdom Light
- Goal - to identify business development strategies for PV installations in Tibet.
- Built on ‘sister city’ program between Lhasa and Boulder
- Two companies are currently installing 200 solar home systems (30-36 W systems) in rural areas of Damschung and Phendrop counties within the Lhasa prefecture.

Rural Energy Training

- Intensive biomass training sessions were conducted in mid-1998 and mid-1999 at NREL on life cycle assessment (LCA) and Geographical Information Systems (GIS) analysis.
- DOE/NREL/MOA co-sponsored a 2-week training for local technicians and government staff at the Asia-Pacific Solar Energy Training Center in Lanzhou during November 1999.
- Brightness Program staff from the Beijing Jikedian Renewable Energy Development Center and northwestern provincial Planning Commissions and policy staff from the State Development Planning Commission (SDPC) will come to NREL in May 2000 for training on rural electrification.

Wind Resource Assessment and Mapping

- DOE/NREL, US EPA, Hydropower General Planning Institute under SP
- Assessed and mapped the southeast China wind resource in the provinces of Jiangxi, Fujian, and the eastern half of Guangdong.
- Best resource - along the coast and on offshore islands, particularly along the coast of Fujian.
- Technical potential for installed capacity in this region - 47,338 MW
- Energy generation potential - 104,853 GWh/yr

Xiao Qing Dao Hybrid Village Power Project

- DOE/NREL, SP, Weihai City Electric Power Bureau, Rushan City Electric Power Bureau
- Pilot project
  - In the Yellow Sea off Shandong Province.
  - 4x10 kW Bergey Excel Wind Turbines; AES inverter; 50 kW diesel genset; battery bank
  - To electrify 120 households
  - Electric Power Bureau staff trained at NREL on hybrid systems
  - Data Acquisition system - performance and operational data will be collected.
  - Installation planned for mid-2000.

Wind Energy Training

- Each year, NREL trains two Chinese engineers in a 2-3 month training program on various topics including: wind resource assessment, hybrid systems modeling, and wind utility interconnection modeling
  - SP - wind resource assessment and mapping techniques during 1996.
  - Beijing Jikedian Renewable Energy Development Center and China Electric Power Research Institute - in hybrid systems modeling and utility wind interconnection modeling during 1997.
  - Fulin Windpower Development corporation trained in hybrid systems modeling during Oct 1999-Jan 2000

Provincial Renewable Business Profiles

- Center for Renewable Energy Development, Xinergy, and DOE/NREL
- 1996 study - described factors that influence the deployment of renewable energy in six provinces.
- 1998 study - included four additional provinces and discussed changes that have been made under China's government restructuring
- Published a report: *Renewable Energy Markets In China: An Analysis of Renewable Energy Markets in Guangdong, Jiangxi, Jilin and Yunnan, with Updated Information from Beijing.*

Chinese PV Technology Assessment

- CRED, DOE/NREL
- Review of the status of PV technology and industry development in China
- Will be published in mid-2000 as a bilingual report: *Commercialization of Solar PV Systems in China*

Chinese PV Industry Assessment

- DOE/NREL, CRED, and Chris Sherring
- Evaluated local PV businesses and applications in 1998
- Including local interviews with a large number of PV cell and module manufacturers, distributors, and integrators
- Published as a report: *PV Business Application and Evaluation*.

Business Development Workshops and study tours

- 1998 US/China Rural Electrification Workshop
  - DOE/NREL/APEC and MOA
  - Provide information to US companies on rural electrification opportunities and plans and facilitate networking between US and Chinese companies.
- 1999 US/China Renewable Energy Business Workshop
  - DOE/NREL and SETC, CRED
  - 13 US companies attended the Xian Solar Energy Society Conference and visited Xinjiang and Gansu
  - This workshop and study tour was fruitful in assisting US companies with potential new customers, distributorships, and partnerships.

Wind Finance Training

- 1999 Wind Energy Business Development and Policy Analysis Workshop, Hangzhou
  - To train Chinese officials and companies in business development for grid-connected wind power
  - DOE/NREL and Princeton Energy Resources International
  - 70 Chinese participants from private sector, government, research institutions

Support for International Programs

- World Bank
  - DOE/NREL provided technical assistance, economic analysis, and wind resource assessments in support of their initiatives for renewable energy development in China.
  - This assistance helped the World Bank to develop a $400M renewable energy project
- United Nations Development Program (UNDP)
  - DOE/NREL provided technical assistance to UNDP to help them develop their $26M renewable energy program.
  - NREL's former China country-lead, Dr. Bill Wallace, is currently working for the UNDP in Beijing as their Senior Technical Advisor

Energy Policy

- 1998 - CRED participated in a policy study of the US with DOE/NREL and prepared a report on a comparison of US and Chinese renewable energy policies.
- This has led to the SDPC advocating several renewable energy policy initiatives and incentives to the State Council.
- These initiatives include the creation of a Renewables Portfolio Standard, reductions in value-added tax for renewables, and establishment of a special Fund for renewables.

Information Dissemination - Internet Websites

- DOE/NREL and CRED
- www.nrel.gov/china
- provides information on the Protocol and business and policy information for companies that are interested in the Chinese markets.
- This will be linked to a Chinese website that will provide information in the Chinese language.

TCAPP Designed to Address Article 4.5 of FCCC

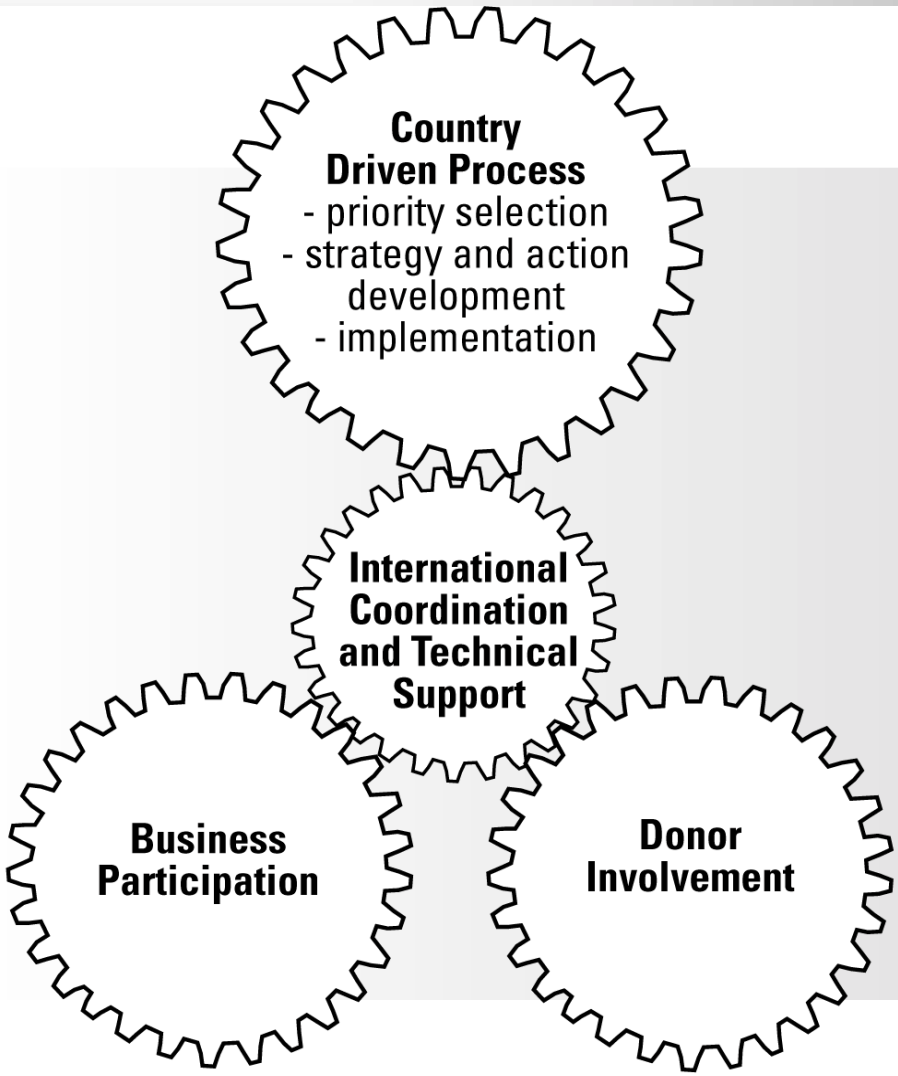
- Article 4.5 : "*The developed country partners…shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing countries…*"

- Gap in Views Between Developed and Developing Countries - Government vs. Market Driven
- DOE, AID, & and EPA Launched TCAPP to Provide Practical Model for Tech. Transfer

TCAPP Objectives

- Foster Private Investment in Clean Energy Technologies
- Engage In-Country and Donor Support for Actions to Build Sustainable Markets
- Establish Model for Technology Transfer Under FCCC
  - Producing tangible results through a country-driven, market-relevant approach

TCAPP Program Elements



Actions

- policy reforms
- investment solicitations and conferences
- commercial pilot projects
- business training
- business financing
- educational programs

Primary Outcomes

- national development priorities achieved
- increased investment in clean energy technologies
- reductions in greenhouse gas emissions

China Technology Cooperation Framework

- Team led by Office of Climate Change Policy Coordination Committee at SDPC, with representatives from MoST, SETC, & Others
- Coordination by Tsinghua University
- Priority Technologies
  - Advanced Coal Power
  - *High Efficiency Electric Motors
  - High Efficiency Industrial Boilers
  - *Grid-connected Wind Power
  - Biomass Gasification
  - Natural Gas Combined Cycle Power

Background of Collaboration

- China interagency team formed - Feb 1998
- Scoping meeting to select priority technologies - Mar 1998
- Meetings with donors to discuss opportunities for collaboration - Mar 1998
- Technology Cooperation Framework completed - Aug 1998
- Participation in Donors Meeting - Oct 1998
- Technology expert meetings held July 1999
- Motors and wind technology analyses and reports completed - Jan 2000
- Investment actions and 2 new priorities selected at Interagency Team Meeting - Jan 2000
- Actions are being further detailed and implemented by wind and motors teams

Wind Actions

- Wind resource assessment and measurement
  - Link to NREL/TERI/UNEP/Riso Global Map effort
  - Joint work on standards and guidelines for measurement
  - Funding for measurement equipment
- Wind turbine testing
  - Discussions at NREL with turbine testing team on testing types, protocols and Chinese priorities
  - Training on testing methods and tools
- Business Partnerships
  - Local workshops: build awareness and support for wind development, educate about competition to reduce costs
  - Case studies or pilots of competitive solicitations
  - Studies of cost reductions through JVs or market potential required for JVs
  - Workshop to present new wind policies or new resource assessment data
  - Training on wind design software
  - US/China study on technology transfer policy incentives

Motors Actions

- Motors training
  - Identify training needs and host institution
  - Secured funding for training activities through UN Foundation
  - Provide motors systems software and training
- Motors testing, certification, standards and labeling
  - Assist in selection of appropriate test protocols
  - Training in testing, standards and labeling
- Motors financing and business partnerships
  - Finance Workshop on finance resources and how-to-access financing
  - Building awareness of motors efficiency technologies